

# Robots on the Moon, and their Role in a Future Lunar Economy

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**Abstract:** With the notable exception of NASA, which has already left a significant footprint, and recently has been driven by Mars and beyond, all prominent space agencies are focusing their near term efforts on the Moon. Moon is more affordable, and a lunar base provides a stepping stone for farther destinations, validation of technologies and mechanisms of international collaboration. Moreover, advances in robotics permit teams of robots to collaborate. Concepts such as that of Moon Village, promoted by ESA, offer a vision of collaboration via assets owned and operated independently by different nations yet engaged in mutual support and assistance in a robotic ecosystem. Yet perhaps the most profound factor affecting the future exploration and use of the Moon comes from the imminent involvement of private entities. The Moon is gradually becoming commercially interesting, as a next logic phase of a space economy, which has proven profitable by Earth-orbiting satellites. This means highly expanded investment and initiatives.

The talk will review current and planned lunar missions illustrating the state-of the art in technologies and operations; then, it will take a leap into the future, presenting a vision of lunar robotic villages, robotic mining operations, and human presence, permanent colonies, and tourism and entertainment zones and discuss what technologies are needed to make this future possible. Among those, perhaps within a decade, and most likely before the end of two decades from now, exploration by robotic intelligence will exceed the capabilities of current human-driven exploration, and become the determining factor in conquering space. Consequences of such a disruptive technology are discussed.

**Bio Note:** Dr. Adrian Stoica has been recently celebrated 21 years of working at NASA Jet Propulsion Laboratory (JPL), California Institute of Technology. Known primarily for the launch of the first US Satellite, for the Voyager spacecraft that has now travel beyond the boundaries of our solar system, and for building and operating the rovers operating on Mars, JPL is the leading NASA Center for robotic space exploration, with over 6000 researchers involved in planning and execution of space missions. Adrian is currently Supervisor of the Robotic Systems

Estimation and Controls Group, acts as Program Executive for Blue Sky Studies Program, and coordinator of the Innovation to Flight Program. He is a NIAC Fellow (NASA Innovative Advanced Concepts) having lead a study on a solar power infrastructure at the lunar south pole. His research interests include robotic intelligence and learning, collaboration between humans and teams of robots, non-conventional computing, and technologies for enhanced quality of life. He has started 3 conferences, the oldest, NASA/ESA Conference on Adaptive Hardware and Systems running yearly since 1999.